CHAPTER 15. ENVIRONMENTAL ASSESSMENT FOR PROPOSED ENERGY CONSERVATION STANDARDS FOR WALK-IN COOLERS AND FREEZERS

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15.1 INTRODUCTION

The U.S. Department of Energy (DOE) will conduct an environmental assessment as part of the notice of proposed rulemaking. DOE will assess the impacts of proposed energy conservation standards for walk-in coolers and freezers on certain environmental indicators using a variant of the Energy Information Administration (EIA)'s National Energy Modeling System (NEMS).[a] EIA uses NEMS to produce the *Annual Energy Outlook (AEO)*.[1] DOE will use a variant known as NEMS-BT to provide key inputs to the analysis, based on the 2010 version of the *AEO* (*AEO2010*). Results of the environmental assessment will be similar to those provided in *AEO2010*.

The intent of the environmental impact assessment is to fulfill requirements to properly quantify and consider the environmental effects of all new Federal rules. DOE intends the environmental assessment to provide emissions results to policymakers and other stakeholders, and to fulfill requirements that the environmental effects of all new Federal rules be properly quantified and considered.

The primary environmental effects of energy conservation standards for walk-in coolers and freezers would be reduced power plant emissions resulting from reduced consumption of electricity; there are also reduced household emissions from gas appliances. The environmental assessment considers three pollutants— sulfur dioxide (SO_2), nitrogen oxides (NO_x), and mercury (Hg)—as well as carbon emissions. The only form of carbon emissions tracked by NEMS-BT is carbon dioxide (CO_2), so the carbon discussed in this report is in the form of CO_2. For each of the trial standard levels, DOE will calculate power sector emissions using NEMS-BT, using additional external analysis as needed.

DOE notes that the Clean Air Act requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards for the following six common air pollutants, also know as "criteria pollutants": (1) ozone, (2) particulate matter (PM), (3) carbon monoxide (CO), (4) nitrogen dioxide, (5) SO_2, and (6) lead.[2] None of the "criteria pollutants" not already considered (i.e., ozone, PM, CO, and lead) are driven significantly by either electric utility power plants or fuel-fired appliances. Therefore, DOE does not intend on addressing them in the environmental assessment. In the case of ozone and particulate matter, other pollutants are precursors to their formation and atmospheric conditions are the driver behind their formation. Also, SO_2 and NO_x are the primary precursors to ozone and PM, respectively, and will already be addressed by the environmental assessment. In the case of CO, electric utilities and fuel-fired

[a] For more information on NEMS, please refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 2003*, DOE/EIA-0581(2003), March 2003. EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because this analysis entails some minor code modifications and the model is run under various policy scenarios that are variations on EIA assumptions, DOE refers to the model as NEMS-BT (BT is DOE's Building Technologies Program). NEMS-BT was previously called NEMS-BRS.

appliances are not significant sources. Finally, with regard to lead, industrial processes (not electric utilities), including primary and secondary lead smelters and battery manufacturers, are responsible for most of the lead emissions.

15.2 METHODOLOGY

DOE plans to conduct the utility impact analysis as a policy deviation from the 2010 version of the *AEO* (*AEO2010*),[1] applying the same basic set of assumptions. For example, the emissions characteristics of an electricity generating plant will be exactly those used in *AEO2010*. The NEMS reference case and alternative growth scenarios are as described in the utility impact analysis (see Chapter 13 of the preliminary technical support document). Below are descriptions of the air emissions that DOE will analyze in the environmental assessment.

15.2.1 Air Emissions

Carbon Dioxide (CO_2)

Carbon dioxide (CO_2) is not a regulated or criteria pollutant, but it is of interest because of its classification as a greenhouse gas (GHG). GHGs trap the sun's radiation inside the Earth's atmosphere and either occur naturally in the atmosphere or result from human activities. Naturally occurring GHGs include water vapor, CO_2, methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Human activities, however, add to the levels of most of these naturally occurring gases. For example, CO_2 is emitted to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), wood, and wood products are burned. During the past 20 years, about three-quarters of anthropogenic (i.e., human-made) CO_2 emissions resulted from burning fossil fuels.

Concentrations of CO_2 in the atmosphere are naturally regulated by numerous processes, collectively known as the "carbon cycle." The movement of carbon between the atmosphere and the land and oceans is dominated by natural processes, such as plant photosynthesis. While these natural processes can absorb some of the anthropogenic CO_2 emissions produced each year, billions of metric tons are added to the atmosphere annually. In the U. S., CO_2 emissions from both energy generation and industrial processes account for 84.6 percent of total U.S. GHG emissions.

In the absence of any Federal emissions control regulation of power plant emissions of CO_2, a DOE standard is likely to result in reductions of these emissions. The CO_2 emission reductions likely to result from a standard will be estimated using NEMS-BT and national energy savings estimates drawn from the NIA spreadsheet model. The net benefit of the standard is the difference between emissions estimated by NEMS-BT at each standard level considered and the *AEO* Reference Case. NEMS-BT tracks CO_2 emissions using a detailed module that provides results with broad coverage of all sectors and inclusion of interactive effects.

Sulfur Dioxide (SO_2)

DOE has preliminarily determined that SO_2 emissions from affected Electric Generating Units (EGUs) are subject to nationwide and regional emissions cap and trading programs that are

likely to eliminate the standards' impact on SO_2 emissions. The costs of meeting such emission cap requirements are reflected in the electricity prices and forecasts used in DOE's analysis of the standards. Title IV of the Clean Air Act sets an annual emissions cap on SO_2 for all affected EGUs. SO_2emissions from 28 eastern States and the District of Columbia (DC) are also limited under the Clean Air Interstate Rule (CAIR, published in the Federal Register on May 12, 2005. 70 FR 25162 (May 12, 2005)), which creates an allowance-based trading program that will gradually replace the Title IV program in those States and DC. (The recent legal history surrounding CAIR is discussed below.) The attainment of the emissions caps is flexible among EGUs and is enforced through the use of emissions allowances and tradable permits. Under existing EPA regulations, any excess SO_2 emission allowances resulting from the lower electricity demand caused by the imposition of an efficiency standard could be used to permit offsetting increases in SO_2 emissions by any regulated EGU. However, if the standard resulted in a permanent increase in the quantity of unused emission allowances, there would be an overall reduction in SO_2 emissions from the standards. While there remains some uncertainty about the ultimate effects of efficiency standards on SO_2 emissions covered by the existing cap and trade system, the NEMS-BT modeling system that DOE plans to use to forecast emissions reductions currently indicates that no physical reductions in power sector emissions would occur for SO_2.

Even if there is no significant reduction in the overall emissions of SO_2 that results from the standard, there may still be some economic benefit from reduced demand for SO_2 emission allowances that is not fully reflected in the cost savings experienced by individual businesses. Electricity savings that decrease the overall demand for SO_2 emissions allowances could lower allowance prices and thereby result in some economic benefits for all electricity consumers, not just those that reduced their electricity use as a result of an efficiency standard. DOE does not plan to monetize this particular benefit because the effect on the allowance price from any single energy conservation standard is likely small and highly uncertain.

Nitrogen Oxides (NO_X)

Nitrogen oxides**,** or NO_X, are the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO_2), along with particles in the air can often be seen as a reddish-brown layer over many urban areas. NO_2 is the specific form of NO_X reported in this document. NO_X is one of the main ingredients involved in the formation of ground-level ozone, which can trigger serious respiratory problems. It can contribute to the formation of acid rain, and can impair visibility in areas such as national parks. NO_X also contributes to the formation of fine particles that can impair human health.[3]

Nitrogen oxides form when fossil fuel is burned at high temperatures, as in a combustion process. The primary manmade sources of NO_X are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fossil fuels. NO_X can also be formed naturally. Electric utilities account for about 22 percent of NO_X emissions in the United States.[3]

NEMS-BT has an algorithm for estimating NO_X emissions from power generation. The impact of these emissions, however, will be affected by the CAIR, which the Environmental

Protection Agency (EPA) issued on May 12, 2005. CAIR will permanently cap emissions of NO_X in 28 eastern states and the District of Columbia. 70 FR 25162 (May 12, 2005)..

Much like SO_2 emissions, a cap on NO_X emissions means that energy conservation standards may have little or no physical effect on these emissions in the 28 eastern States and DC covered by CAIR. Although CAIR has been remanded to the EPA by the DC Circuit, it will remain in effect until it is replaced by a rule consistent with the Court's July 11, 2008, opinion in North Carolina v. EPA. 531 F.3d 896 (DC Cir. 2008); see also North Carolina v. EPA, 550 F.3d 1176 (DC Cir. 2008). Because all States covered by CAIR opted to reduce NO_X emissions through participation in cap-and-trade programs for electric generating units, emissions from these sources are capped across the CAIR region.

Standards may produce an environmental-related economic benefit in the form of lower prices for emissions allowance credits. .As with SO_2 emissions, a cap on NO_X emissions means that equipment efficiency standards may have no physical effect on these emissions in the 28 eastern States and DC covered by CAIR. While the emissions cap may mean that physical emissions reductions will not result from standards in those states covered by CAIR, standards could produce an environmental-related economic benefit in the form of lower prices for emissions allowance credits.

As with SO_2 allowance prices, DOE does not plan to monetize this particular benefit because the effect on the NO_X allowance price from any single energy conservation standard is likely small and highly uncertain.

Accordingly, DOE plans to use NEMS-BT to estimate the emissions reductions from possible standards in the 22 States where emissions are not capped.

Mercury (Hg)

Coal-fired power plants emit Hg found in coal during the burning process. While coal-fired power plants are the largest remaining source of human-generated Hg emissions in the United States, they contribute very little to the global Hg pool or to contamination of U.S. waters. U.S. coal-fired power plants emit Hg in three different forms: oxidized Hg (likely to deposit within the United States); elemental Hg, which can travel thousands of miles before depositing to land and water; and Hg that is in particulate form. Atmospheric Hg is then deposited on land, lakes, rivers, and estuaries through rain, snow, and dry deposition. Once there, it can transform into methylmercury and accumulate in fish tissue through bioaccumulation.

Americans are exposed to methylmercury primarily by eating contaminated fish. Because the developing fetus is the most sensitive to the toxic effects of methylmercury, women of childbearing age are regarded as the population of greatest concern. Children exposed to methylmercury before birth may be at increased risk of poor performance on neurobehavioral tasks, such as those measuring attention, fine motor function, language skills, visual-spatial abilities, and verbal memory.

Similar to emissions of SO_2 and NO_X, future emissions of Hg would have been subject to emissions caps. In May 2005, EPA issued the Clean Air Mercury Rule (CAMR). 70 FR 28606 (May 18, 2005). CAMR would have permanently capped emissions of mercury for new and existing coal-fired power plants in all States by 2010. However, on February 8, 2008, the DC Circuit issued its decision in New Jersey v. Environmental Protection Agency, in which the DC Circuit, among other actions, vacated the CAMR. 517 F.3d 574 (DC Cir. 2008). EPA has decided to develop emissions standards for power plants under the Clean Air Act (Section 112), consistent with the DC Circuit's opinion on the CAMR. See http://www.epa.gov/air/mercuryrule/pdfs/certpetition_withdrawal.pdf. Pending EPA's forthcoming revisions to the rule, DOE is excluding the CAMR from its Environmental Analysis. In the absence of CAMR, energy conservation standards would likely reduce Hg emissions, and DOE plans to use NEMS-BT to estimate these emission reductions.

Particulate Matter

DOE acknowledges that particulate matter (PM) impacts are of concern due to human exposures that can impact health. However, impacts of PM emissions reduction are much more difficult to estimate than other emissions reductions due to the complex interactions between PM, other power plant emissions, meteorology, and atmospheric chemistry that impact human exposure to particulates. Human exposure to PM usually occurs at a significant distance from the power plants that are emitting particulates and particulate precursors. When power plant emissions travel this distance, they undergo highly complex atmospheric chemical reactions. Although the EPA does keep inventories of direct PM emissions of power plants, in its source attribution reviews, the EPA does not separate direct PM emissions from power plants from the sulfate particulates indirectly produced through complex atmospheric chemical reactions. The great majority of PM emissions from power plants are of these secondary particles (secondary sulfates). Thus, it is not useful to examine how the amended standard impacts direct PM emissions independent of indirect PM production and atmospheric dynamics. Therefore, DOE is not planning to assess the impact of these standards on particulate emissions. Further, even the cumulative impact of PM emissions from power plants and indirect emissions of pollutants from other sources is unlikely to be significant.

15.2.2 Monetization of Emission Reductions Benefits

For those emissions for which real national emission reductions are anticipated (CO_2, Hg, and NO_X for 22 states), ranges of estimated economic values based on environmental damage studies of varying quality and applicability are available. Therefore, DOE plans on reporting estimates of monetary benefits derived using these values and plans to consider these benefits in weighing the costs and benefits of each of the standard levels considered.

Carbon Dioxide (CO_2)

In order to estimate the monetary value of benefits resulting from reduced emissions of CO_2 emissions, it is DOE's intent to use in its analysis the most current Social Cost of Carbon (SCC) values developed and/or agreed to by interagency reviews. The SCC is intended to be a monetary measure of the incremental damage resulting from greenhouse gas (GHG) emissions, including, but not limited to, net agricultural productivity loss, human health effects, property

damage from sea level rise, and changes in ecosystem services. Any effort to quantify and to monetize the harms associated with climate change will raise serious questions of science, economics, and ethics; but with full regard for the limits of both quantification and monetization, the SCC can be used to provide estimates of the social benefits of reductions in GHG emissions.

At the time of this notice, the most recent interagency estimates of the potential global benefits resulting from reduced CO_2 emissions in 2010 are $4.7, $21.4, $35.1, and $64.9 per metric ton in 2007 dollars. These values are then adjusted to 2009$ using the standard GDP deflator value for 2008 and 2009. For emissions (or emission reductions) that occur in later years, these values grow in real terms over time. Additionally, the interagency group determined that a range of values from 7 percent to 23 percent should be used to adjust the global SCC to calculate domestic effects, although preference will be given to consideration of the global benefits of reducing CO_2 emissions. To calculate a present value of the stream of monetary values, DOE will discount the values in each of the four cases using the discount rates that had been used to obtain the SCC values in each case. See appendix A of the Annex to this chapter for the full range of annual SCC estimates from 2010 to 2050.

DOE recognizes that scientific and economic knowledge continues to evolve rapidly as to the contribution of CO_2 and other GHG to changes in the future global climate and the potential resulting damages to the world economy. Thus, these values are subject to change.

Nitrogen Oxides (NOx)

As discussed earlier, with respect to NOx the CAIR rule has been reinstated by the courts. Therefore, NOx emissions in those states covered by CAIR will be subject to a cap with corresponding annual allowances openly traded.

For those states not covered by CAIR, DOE plans on estimating the monetized benefits of NOx emissions reductions in these states based on environmental damage estimates from the literature. Available estimates suggest a very wide range of monetary values for NOx emissions, ranging from $370 per ton to $3,800 per ton of NOx from stationary sources, measured in 2001$, (equivalent to a range of $447 to $4,591 per ton in 2009$).[4]

Mercury (Hg)

DOE plans on estimating the monetized benefits of Hg emissions reductions based on environmental damage estimates from the literature. For Hg emissions reductions, DOE has previously determined that the basic science linking mercury emissions from power plants to impacts on humans is considered highly uncertain. However, DOE identified two estimates of the environmental damages of mercury based on two estimates of the adverse impact of childhood exposure to methyl mercury on IQ for American children, and subsequent loss of lifetime economic productivity resulting from these IQ losses. The high-end estimate is based on an estimate of the current aggregate cost of the loss of IQ in American children that results from exposure to mercury of U.S. power plant origin—$1.3 billion per year in 2000$, which translates to $33.7 million per ton emitted per year in 2009$.[5] DOE derived the low-end estimate of $0.66 million per ton emitted in 2004$, or $0.745 million per ton in 2009$, from a published evaluation

of mercury control using different methods and assumptions from the first study, but also based on the present value of the lifetime earnings of children exposed to mercury.[6 b]

For both NO_X and Hg, DOE will conduct two calculations of the monetary benefits derived using each of the economic values used, one using a real discount rate of 3 percent and another using a real discount rate of 7 percent, in accordance with the U.S. Office of Management and Budget (OMB) guidance.[c]

15.3 RESULTS

The results for the environmental assessment are similar to a complete NEMS run, as published in the *AEO2010*. These include emissions for SO_2, NO_X, mercury, and CO_2 in five-year forecasted increments, extrapolated to the year 2045. DOE will report the outcome of the analysis for each trial standard level as a deviation from the *AEO2010* reference case results.

[b] The estimate was derived by back-calculating the annual benefits per ton from the net present value of benefits reported in the study.

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